solplan review

the independent newsletter of energy efficient building practice

the drawing-room graphic services ltd.
box 86627 north vancouver b.c. V7L 4L2

No. 20 April–May 1988

INSIDE....

Changes being made to Building Codes which call for increased airtightness and mechanical ventilation are creating much unrest in the building industry.

This issue we focus attention on the airtightness aspects of new homes.

John Timusk points out that one of the most common problems in wood frame houses is the formation of mould and mildew on inside wall surfaces at exterior corners. Most problem houses studied were new (built since 1975), electrically heated but 'naturally ventilated'. Inadequate ventilation was one of the contributing factors, as was the cooling of wall surfaces because of leaky building envelopes.

Jim Currie explains why he's against airtightness and mechanical ventilation requirements in the Building Code. We describe why we think tight envelopes and ventilation are an important element in good construction.

Other items include results of thermographic scans of airtight walls, heat losses at roof eaves, information on a flueless wood stove, improved efficiency window framing materials, and news about a new energy efficient home program.

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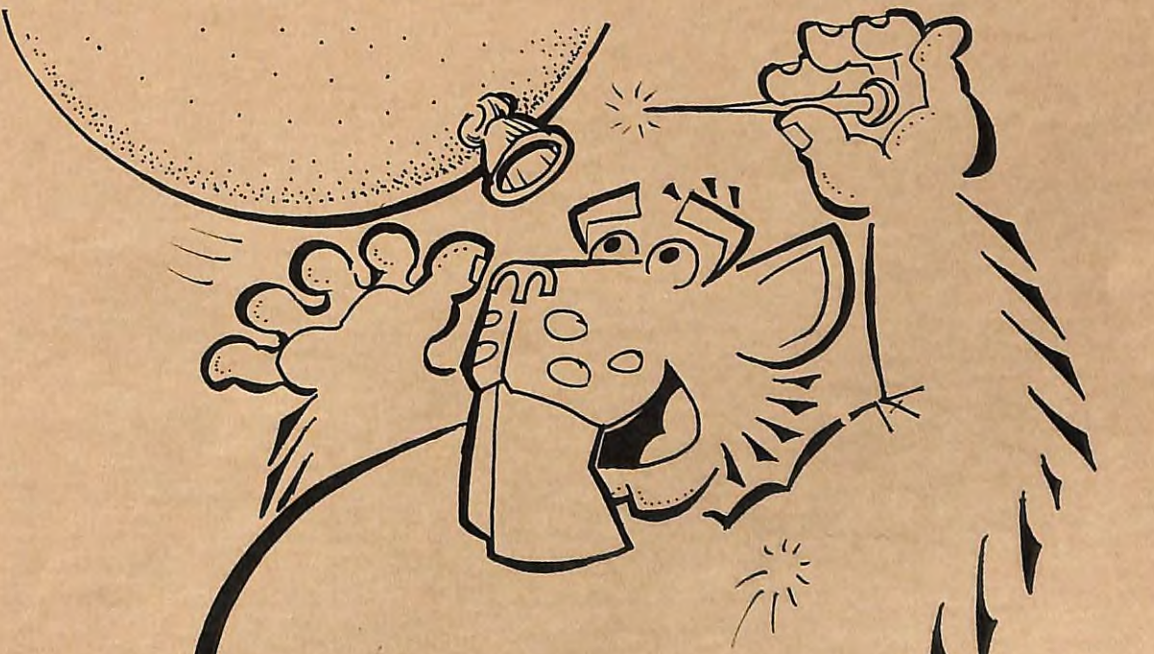
AIRTIGHTNESS



FROM THE PUBLISHER

We started SOLPLAN REVIEW to provide coverage of low energy building technology. We observed that there was a need for an independent technically up-to-date journal to provide information to builders and designers of quality, energy efficient housing.

SOLPLAN REVIEW was started as a business venture. We knew it would be a while before it did more than just recover expenses (which is why we still find ourselves without much competition), so we have kept a watchful eye on other publications.

We had some concerns when an Edmonton based publication went national. But what HABITAT 2000 set out to do was different. It was the only mass circulation publication for the Canadian homebuilding industry. In some respects it overlapped on our turf. But as an advertiser dependent, controlled circulation paper it was a totally different being (and it even used my contributions).

We say HABITAT 2000 **was** as this month Chris Bamford, the publisher, decided to cease publication. Although in a way it was a rival, it is sad to see its end. It is a sad commentary on our industry that a publication like HABITAT 2000 could not make it due to poor advertiser support.

I would like to assure our readers that we will carry on. Your encouraging comments and contributions tell us we are doing something right (and we have readers in all parts of Canada, the USA and 5 European countries). However, it would nice to have a larger subscription list - and it would be wonderful to get more than fifty cents an hour for the effort (so encourage all your friends and colleagues to subscribe!).

Richard Kadulski
Publisher

NEW ENERGY EFFICIENT HOME PROGRAM

After many years of supply side energy planning, B.C. Hydro has recognized that energy conservation (demand side management) makes economic sense. It is cheaper to avoid using energy than to build new hydro dams or generating capacity.

The utility will be soon be launching a new energy efficient home program. It is hoping that 50% of all new housing starts in the service area will be enrolled in the proposed program. To get this number of housing units, they will mount a sizable marketing drive aimed at the public, to create a demand. The sums being talked about are many times the current annual R2000 marketing budget for B.C.

The technical requirements will be similar to the R2000 Program, except that it will be a prescriptive standard for varying climate zones with an air tightness requirement (1.5 air changes per hour @50 Pascals) and HRV'S mandatory in areas with design temperatures lower than -10°C. Builder education and quality assurance will be an important part of the program.

The administration will be handled by CHBA B.C. Details are still being worked out, but this program will effectively mean that the R2000 program will evolve into this utility sponsored program. The target date for the official launch is early 1989 (builder education programs will start this fall).

SOLPLAN REVIEW is published 6 times per year by The Drawing-Room Graphic Services Ltd. Box 86627, North Vancouver, B.C. V7L 4L2
Tel: 604-689-1841 ISSN: 0828-6574
FAX: 604-689-1401

SUBSCRIPTIONS: $30.00 per year.
U.S.A. and other foreign subscriptions payable in U.S. funds or $36.00 Canadian.
Unsolicited contributions and manuscripts welcome. Include self-addressed pre-stamped mailer if return requested. Publisher not responsible for loss or damage of same.
Second Class Mail Registration No. 6855
Date of Issue: May 1988 Printed in Canada

WIND COOLING OF STRUCTURES

By J. Timusk
A. L. Seskus
N. Ary

Wind Cooling Of Wood Frame Buildings

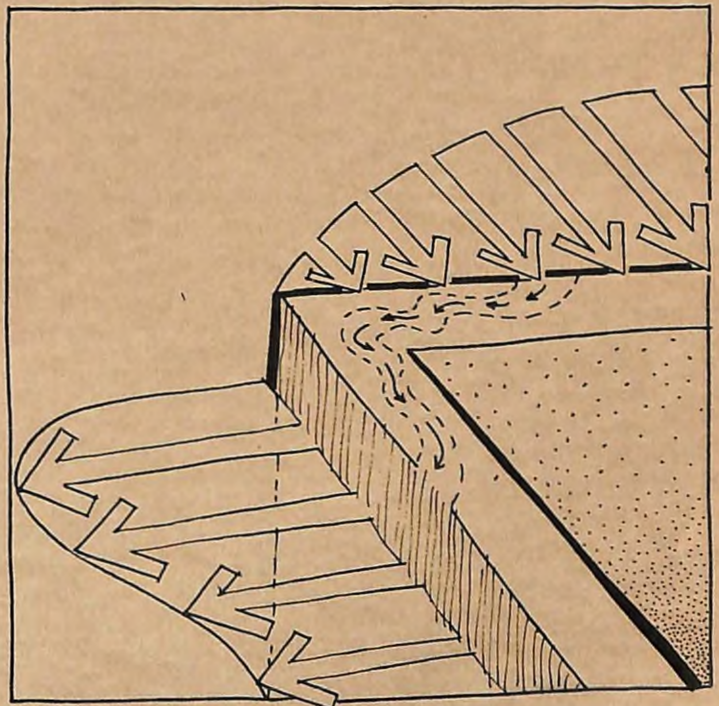
Changes in building materials and construction methods since 1945 have, in some cases, created air quality and moisture problems. Even before the 1973 oil embargo houses were becoming too tight for natural ventilation to control indoor moisture and pollutants. The problem in leaky cold-climate houses was lack of moisture, but the reverse became the issue when building envelopes became too tight. Better fitting doors and windows, polyethylene vapour retarders, low permeability siding and sheathing material and taped gypsum board all contributed to the problem.

Perhaps the most important culprit was flueless heating. In the traditional house heated with a fuel furnace, the chimney acted as a powerful exhaust fan, removing spent air and moisture. However, in electrically heated houses 'natural ventilation' had to be relied on. This kind of ventilation, unless controlled manually by the home owner through the appropriate opening and closing of windows, is essentially ventilation driven by the weather; too much during cold and windy weather, too little when warm and calm.

Thus it is not surprising that air quality and moisture problems appeared in housing, often in social housing where there seems to be an incompatibility between the building's design and operation. Such moisture problems are not exclusive to cold-climate regions, nor peculiar to wood frame housing. If anything, moisture problems are more serious in the thermally massive houses of moderate climates than in the wood frame houses of northern regions.

A Canada-wide study of moisture problems in housing produced some interesting observations. Although moisture problems were found to occur, they were generally considered superficial, falling into the 'less than adequate serviceability' category. Not a single incident was encountered where decay of timber could have resulted in structural collapse. One of the most common problems was mould and mildew on interior surfaces of exterior corners. Where exterior walls came together, or where an exterior wall met an insulated ceiling, surface temperatures were low enough to create moisture conditions generating mould and mildew growth.

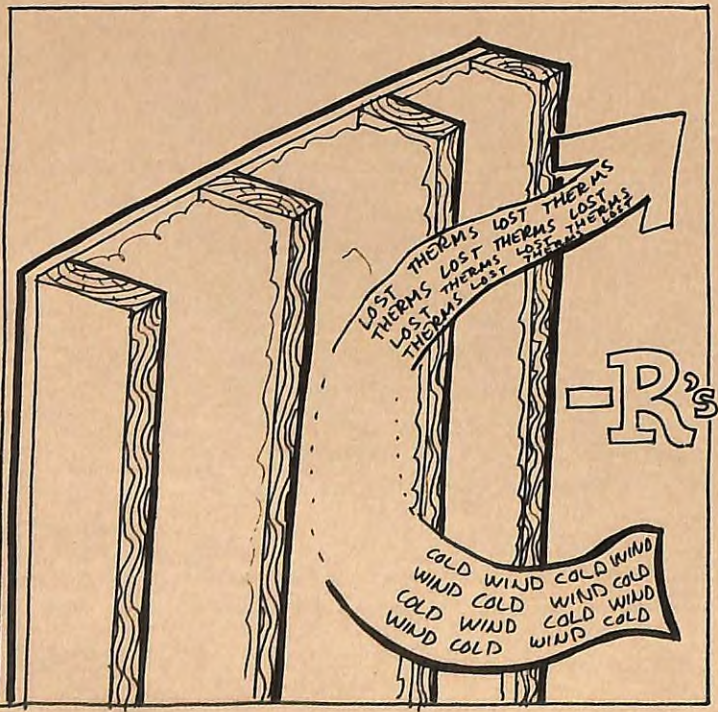
A number of factors are responsible for the lowered surface temperature in such locations. Framing techniques concentrate studs and wall plates in corners creating thermal bridging. Heat flow in corners is two-dimensional, so the thermal bridge affectively is large. A reduction of radiation received from the interior of the room also contributes to added heat loss. In the soffit area, space is not always adequate to accommodate the desired thickness of insulation.



Cold air pushed by wind pressure can flow right through porous insulation and out the leeward side, this cooling the wall.

However, simple calculations suggest that these factors are not enough to explain the mould and mildew growth that is often observed. Defects in the sheathing and siding permit wind to blow in and out of the wall cavities without actually penetrating the wall itself. The rapid change from positive to negative wind pressure at an outside corner results in cold outside air taking a short cut through the wall. For this to happen, there must exist continuous air passages into the wall through the siding and sheathing, around the corner within the wall and out again through the siding-sheathing. These continuous air passages are due to the careless installation of sheathing, to the air permeability of glass fibre insulation and to spaces between studs and gypsum board caused by shrinkage.

Similarly, air pressure under the windward soffit can cause wind to blow through the exposed face of attic insulation. Unfilled corners between the ceiling gypsum board and the attic joists present passages with little resistance to wind. In some instances air velocities into the attic have been high enough to scour away unprotected loose fill insulation. Wind-driven snow can also blow into the attic through the soffit vents.



These phenomena are due to deficiencies in the wind protection provided for the insulation (allowing forced convection to cool the weather-side of the gypsum wall board to near-outside temperatures) and on the other hand, to indoor relative humidities high enough to lead to surface condensation and mould growth.

Forced convection through parts of the thermal envelope will also result in an increase in heat loss. The lack of mould and mildew in corners does not necessarily mean that wind cooling of walls is not taking place. It could be that the indoor relative humidity is too low to cause corner condensation.

Investigations dealing with moisture problems in wood frame houses suggest that wind cooling of walls can be reduced by moving the air barrier from its traditional location on the room-side of the insulation to the weather side. On the outside it would perform two functions: reduce air leakage through the walls and control wind cooling. Such an air barrier would, however, have to be sufficiently vapour permeable to avoid trapping condensed moisture in the wall construction.

LAB TESTS

A laboratory investigation of wind cooling of walls and suggested remedial measures was undertaken with funding made available by the Imperial Oil Limited University Research Grant Program. A full scale wood-frame wall corner unit was constructed in the laboratory. The header joist and the ceiling were insulated, and a baffle was provided to protect the exposed edge of the attic insulation. The soffit was equipped with a conventional vent running the full length.

In addition to creating "unintentional" air leakage paths through the sheathing and within the walls, gaps between the studs and polyethylene air barrier/vapour retarder were formed by means of thin shims. This simulated gaps formed by twisting or shrinkage of studs. Continuous air passages into the wall from the windward face, along the wall cavity and out again through the wall face exposed to wind suction were thus created. Tests were

conducted for various combinations of sheathing gap openings and pressure gradients. Gaps in the sheathing were taped when tight construction was to be simulated.

Temperatures on the weather side of the walls, within the wall construction, and on the room-side surfaces were continually monitored.

The results showed surface cooling due to thermal bridges, two-dimensional heat flow at the corner, reduced convective and radiant heat gain into the wall from the interior. Temperatures in the extreme corner are lowest; the thermal bridge effect of the studs also is clearly evident. Insulating sheathing would significantly reduce such thermal bridge effects.

Based on the measured temperatures, condensation would occur when indoor relative humidity reaches 65%. When wind cooling is superimposed, condensation at 40% relative humidity. This is clearly within the range of humidities encountered in poorly ventilated houses.

Tests also demonstrated that furniture placed in the corner, without actually touching the wall, significantly cooled the wall surface by reducing radiant heat gain from the room and by interfering with air flow.

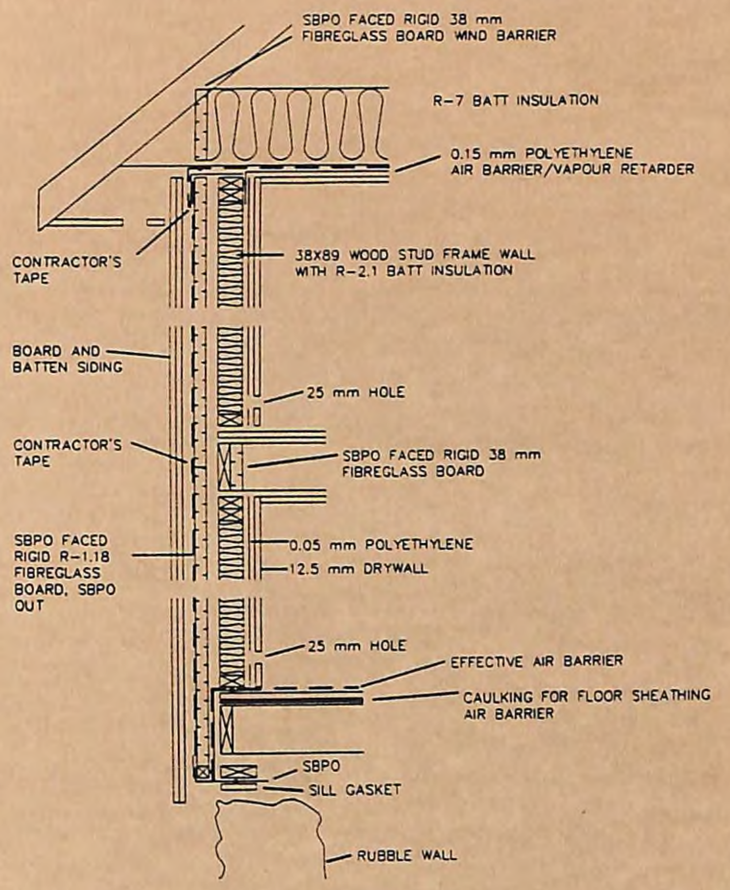


Fig. A

CROSS SECTION THROUGH THE THERMAL ENVELOPE OF THE TEST HOUSE.

DEMONSTRATION HOUSE

A house was built to demonstrate the practicality of locating the air barrier on the outside face of the wall insulation. The house construction is shown in Fig. A.

After the building was closed in, but before installation of the drywall, the house was tested for tightness. Using a standard blower door, the air leakage rate at 50 Pascals was 1.56 air changes per hour (ACH). Calculations indicated that of this 57% was through the Tyvek membrane, the remainder through the usual air leakage openings in the thermal envelope (doors, windows and taped joints between Tyvek sheets). This showed that a Tyvek membrane can be used as the air barrier to control air leakage through the building envelope. Indeed, only some 0.66 ACH would fall into the 'objectionable' category where relatively large leakage openings could lead to cold drafts on infiltration or moisture damage on exfiltration.

When most of the gypsum board, electrical wiring and a wood stove had been installed, the air leakage rate (at 50 Pa) had decreased to 1.33 ACH reflecting the contribution of the gypsum wall board to air tightness. When 1" diameter holes were drilled through the gypsum board (one hole for roughly half the stud cavities in the house) the air leakage rate only increased to 1.51 ACH. The purpose of these holes is to admit ventilation air when the house is operated under a slight negative pressure. The ability of such walls to recover part of the heat otherwise transmitted through the wall as well as to capture solar energy to prewarm the incoming ventilation air has been described, elsewhere (this is the **dynamic wall**, described in SOLPLAN REVIEW No.14. April-May 1987).

There are several arguments in favour of achieving the air tightness by locating the

air barrier on the weatherside of the insulation. The air barrier is not penetrated by partition walls, electrical outlets or joist assemblies. Installation, inspection and, if necessary, remedial action can be carried out easily.

The effectiveness of the Tyvek as a wind barrier was observed in tests which measured the temperature of the inside wall surface of the windward corner. The interior surface was, as expected, warmer due to the insulating sheathing which reduces thermal bridging and the Tyvek air/wind barrier which prevents cold air from taking a short-cut through the wall from one wall face to the other.

While these readings were being taken the house was under a negative pressure strong enough to draw in ventilation air through the Tyvek and the wall.

In the design and construction of the soffit care was taken to prevent cold air from blowing into the exposed edge of the attic insulation by installing tight-fitting Tyvek covered pieces of insulating sheathing between the roof trusses. Entry of wind-driven snow into the attic was controlled by leaving a narrow gap between the top of the sheathing baffle and the roof sheathing. By making this gap narrower than the soffit vent opening, the velocity of the air through the soffit vent was reduced. Were any snow carried through the soffit vent, it would be deposited in the relatively large soffit box.

SUMMARY

Deficiencies in the sheathing can cool the exterior walls, especially at exterior corners. The cooling increases heat loss, and where there are high humidities, leads to mould growth on wall surfaces. Moving the air barrier from its customary location on the warm side of the insulation to the cold side where it is easier to make continuous, improves the performance of the wall.

This article is based on a paper presented at the 6th Annual International Energy Efficient Building Conference, April 27-29, 1988 in Portland, Maine.

J. Timusk, is chairman of the Centre for Building Science and Professor of the Department of Civil Engineering, University of Toronto.

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N. Ary is a Building Scientist and Real Estate Economist with the IBI Group.

AIRTIGHT CONSTRUCTION

The following item was written by J.C. Currie, the retiring Director of the B.C. Building Standards Branch. (The agency responsible for the Building Code in British Columbia).

This item was widely circulated by the B.C. Building Standards Branch, as a rationalization for moving backwards on changes to the building code. It represents widely held opinions in the building community. The question is, how far should codes and regulations go to ensure health, safety and comfort for residents?

We welcome reader comments on this issue.

Traditional wood-frame construction uses lumber in a way favorable to a long life. Wall studs, whether green or dry when used, dried to an acceptable moisture level in service through the permeability of wall construction, which allowed the ready passage of water vapour to the exterior. The shiplap sheathing plus a permeable cladding contributed to a "breathing" system.

Over the years various components have been "improved" through the development of new materials, and new philosophies have changed components to improve individual performances in response to perceived needs. With these changes it seems that sight has been lost of the basic fundamentals which ensured the longevity of wood-

frame structures. We have had the capability of improving and retaining the advantages, but have dealt with the issues piecemeal, probably in response to special interests, and apparently without regard to the whole. The end result is that we are taking steps to correct problems that we ourselves have created.

Currently it is standard practice to use plywood or waferboard sheathing and this in itself constitutes a vapour barrier, effectively preventing the migration of water vapour to the exterior. It appears to have been assumed that sufficient leakage existed to permit drying of the wood frame, provided that a very effective vapour barrier prevented the further passage of water vapour from the interior. As well, there is an increasing use of impermeable exterior cladding.

A further problem is the inclusion of the term "air barrier" in the Code. This is an undefined, nebulous object, interpreted by devotees as anything from permeable Tyvek to a zero perm plastic/rubber asphalt sheet. To say that it is causing confusion would be a considerable understatement, yet I think that it is a critical factor for a successful wall system.

I contend that this is extremely poor construction. The moisture content of lumber when installed must, by the code, be 19% or less, a level classed as "dry" for grading purposes, but I question whether this is ever checked on a building site. Lumber is often "green" or even saturated when delivered. With reasonable weather conditions the surface moisture will quickly evaporate, but the framing could be enclosed long before reaching the 19% level. At 20% or more, with the material located within an unventilated space, we have an ideal condition for wood fungus. I would anticipate that even dry rot, a fungus previously uncommon in wood-frame housing, could become prevalent. It has been suggested that the small gaps required between sheathing panels would permit drying out, but this is unrealistic optimism. The situation is even worse with the apparent failures of polyethylene, generally used for vapour barriers, leaving the interior surface relatively unprotected, but still with an impermeable outer system. I question whether normal lumber will be capable of withstanding the treatment to which it is now subjected.

In the area of ventilation I also think we have a serious problem; there is an obvious need for breathable air, in addition to the air requirements for the usual air using appliances, but airtightness is placing this in jeopardy. For health I assume that an air quality as good as that existing outside is the goal for our purposes. The question of comfort factors is irrelevant unless they impinge on health.

In the past it has been acceptable to open windows for ventilation, and this, coupled with the usual air leaks has provided a reasonable level of health safety. We have now sealed all the leaks, making a house virtually airtight, and are requiring mechanical ventilation. Whether intended or not we are halfway towards full air-conditioning, and unless we reassess the situation have no alternative but to go the rest of the way, certainly beyond the R2000 standard.

In sealing a house we have prevented the normal action which resulted in the dissemination of contaminants to the outside, through a permeable structure. Initial problems have included the urea-formaldehyde fiasco. While this highlighted the issue of contaminant entrapment, the bottom line is that we simply do not know at this time what hazards we are trapping within sealed houses. Minor substances, ignored in the past because people were simply never seriously exposed to them, may now surface as major issues. One which comes readily to mind is radon, written off in the past as a problem only in certain geographical areas, but now being looked at on a continental basis. It may take years for the incidence of lung cancer associated with this substance to show an increase, but by then it could be too late. To guard against this problem will require sealed basements, something not yet addressed in the Code.

In effect we have created a potentially hazardous environment without building in the necessary protective measures. When we

seal a house we must assume entrapment of airborne contaminants and remove these mechanically, and must also prevent ground based contaminants from permeating into the house. With these general principles we at least protect occupants to a reasonable degree from future hazards, not yet understood. However, whatever name we choose to use, we are basically dealing with the air-conditioning of houses, and this is a contentious issue. I do not believe that the Canadian public is ready to accept this as a mandatory requirement, on either philosophical or economical grounds.

I think that the Code should take a very definite step backwards, and accommodate the original fundamentals of wood frame construction. For this purpose I suggest the following:

(1) If the exterior cladding is impermeable, then require that it be spaced out to ensure rear ventilation.

(2) Provide a permeable air-barrier. **"Tyvek"** over the sheathing is ideal for this purpose. This should be tightly fitted at all openings, to prevent wind penetration into the framing system.

(3) Sheathing should be at least as permeable as **"Tyvek"**. For this purpose the normal plywood or waferboard should not be acceptable unless spiked or otherwise treated to ensure adequate permeability.

(4) Install thermal insulation between the studs in accordance with normal practice, but omit an impermeable vapour barrier. I am unconvinced as to the necessity of a highly impermeable vapour barrier except under extreme cold conditions, and feel that this was a requirement generated mainly in an attempt to solve problems created by the use of an impermeable outer system. With a breathable outer system I would prefer something similar to the old kraft paper on the inside, or even standard painted drywall without a separate vapour barrier.

(5) Provide make-up air for the interior. We would be removing the worst leakages by using Tyvek but I think that appliances, such as fireplaces, using air for combustion should have a direct supply from the exterior. I would make no mandatory provision for other air-using appliances. I think there is a sufficient cushion in air availability normally to accommodate these, and there should be the capability of opening windows.

I think that mechanical ventilation, heat recovery systems, and the other aspects of full or partial air-conditioning should be an alternative. If followed, this should be complete, including sealing the general structure and basements. These would be comfort provisions for the occupants, but would still require the permeable outer system mentioned above.

Such a system should, however, be a clear option for an owner. They could either build to the minimum standards necessary for health; or, they could exceed these if a higher level of comfort was considered desirable, but still without compromising health.

J.C. Currie

The author makes a number of points that merit comment.

Construction Moisture (use of saturated wood)

Existing codes do not accept the use of saturated lumber during construction. However, evidence suggests that where it is used, even in moist areas, over time the saturated lumber does dry out to safe levels. Most moisture problems in wall cavities are found in regions with cold spring weather (April, May), lots of driving rain during winter and spring, little sunshine in spring and windy exposed locations. In Canada, this applies mostly to areas of Atlantic Canada.

Rarely will the wall cavity be actually built tightly enough for the structural materials not to have a chance to dry out over a period of time. Measurements of moisture in tight energy efficient wood frame houses show moisture content drops to

about 9 - 13% one or more years after construction.

The intent of the code air sealing provisions is to reduce the incidence of condensation in the walls, to avoid structural damage, which has been a problem in the past. Moisture penetration into the construction is air driven - not by diffusion through materials. That is why it is less important to maintain the continuity of the vapour barrier. A side effect of tightening of the envelope is the improvement of the interior comfort and energy conservation.

The "air barrier" is simply the barrier to air movement across the building envelope to control air infiltration or exfiltration. Any number of building materials can act as the air barrier - it can be the Tyvek, plywood, waferboard, or drywall - providing its continuity is maintained. Generally the air barrier will be a composite of different materials at various locations.

Ventilation

Mechanical ventilation requirements were not introduced into the code as a result of increased air sealing. Rather the intent of the changes was to improve air quality generally and in particular to avoid excessive indoor humidity, odours, and other common pollutants. These are concerns regardless of the house tightness. Indoor air quality studies indicate as many or more air quality problems in older houses as may exist in the tightest new construction.

The entrapment of contaminants inside the house is a reflection of the construction practices and materials used today. The only correct way to deal with these is not to use the offending materials in the first place. Ventilation as a solution to building product contamination is only a band-aid solution. While traditional "leaky" construction dissipated these contaminants, they also produced drafty houses.

Today's homebuyers are increasingly demanding better quality and comfort, which generally means tighter, draft-free construction. Houses have become tighter due to a variety of market driven factors including new building materials (such as better doors, windows and a variety of sheet materials).

Radon has become an issue because of a greater awareness of its significance. High concentrations have been observed in many older houses. Properly built low energy houses (with mechanical ventilation) generally have far lower radon concentrations than standard homes. The best remedy is to seal contaminants out of the building envelope. This simply is good building practice. Perhaps it is not reasonable to expect that good building practice can be mandated in a code.

Conditioning of houses

Comfort must be considered by code authorities because discomfort to occupants will cause the homeowner to do whatever is needed to overcome it. Homeowner modifications could upset the proper operation of the house (creating unsafe conditions in the house).

We are dealing with the air conditioning of houses (in its most generic meaning: the control of temperature, humidity, and air quality not just cooling). It is difficult to believe that the Canadian public is not ready to accept this as a mandatory requirement. Vast sums are spent on a wide range of furnaces, heaters, humidifiers, dehumidifiers and filters. There are no locations in Canada that do not require some form of heating, nor are there any houses that do not contain at least a simple space heater.

If we are going to use conditioning equipment, lets do it correctly! There is no reason why it should be necessary to "go beyond the R2000 standard". Effective functional systems need not be elaborate.

It is especially disturbing to see the suggestion that mandatory combustion air provisions are not necessary (other than for fireplaces). **There is much evidence that there are problems with combustion appliances in existing housing stock.** On this issue any error should be on the side of safety.

Inadequate ventilation may contribute to accumulation of odours and humidity - creating stuffy interiors, but improper

conditions for combustion can lead to incomplete combustion. **Incomplete combustion can cause dangerous concentrations of toxic gasses.**

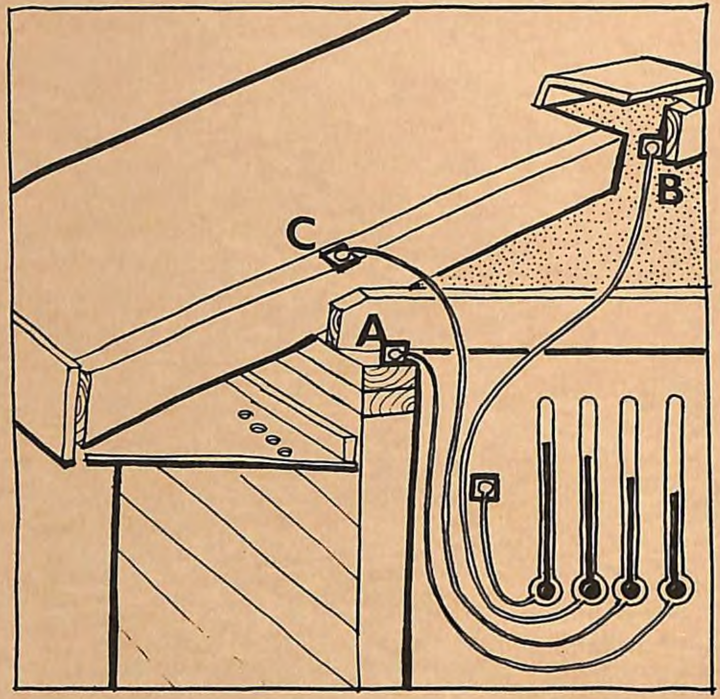
Codes are meant to deal with minimum standards for health and safety. The minimums must deal with the issues in a technically correct manner, reflecting how people actually use the built environment.

Richard Kadulski

EAVE HEAT LOSS

Wind washing through the insulation in the heel of a truss (at the eaves) lowers the value of any insulation placed in the attic. It creates cold spots where thermal bridging and condensation become evident. In extreme cases, where there are no stops, insulation can be blown away creating areas with no insulation.

Just how serious is the heat loss due to eave wind washing? Recent tests done at the University of Calgary for R Plus Industries have produced exact measurements.



Test #1

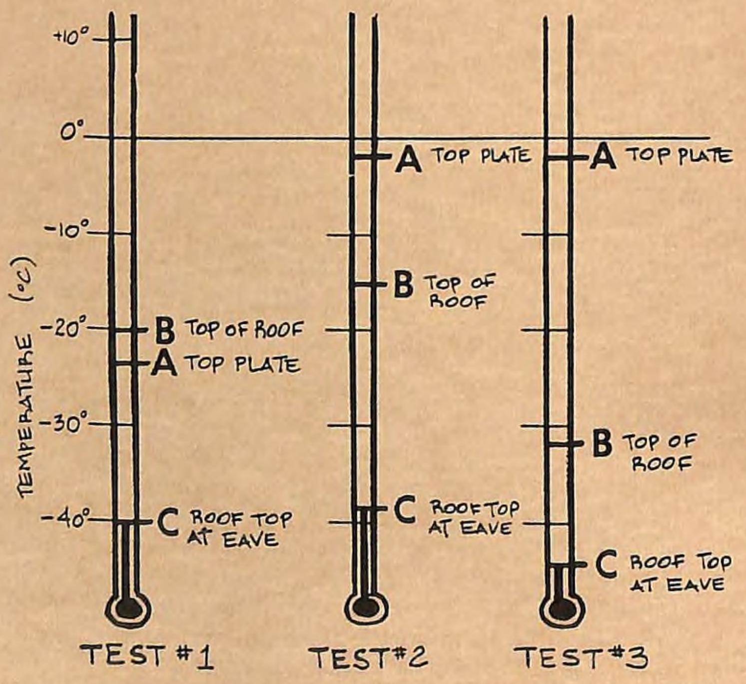
The roof edge had a cardboard stop but no insulation. The temperature at the top wall plate and the ambient temperatures follow each other very closely. This would mean a very cold spot ideal for surface condensation and mould and mildew growth on the inside surface.

Test #2

An insulation block (that also stops wind washing) was placed at the eave but no ceiling insulation. There is significant improvement in the thermal protection of the wall plate.

Test #3

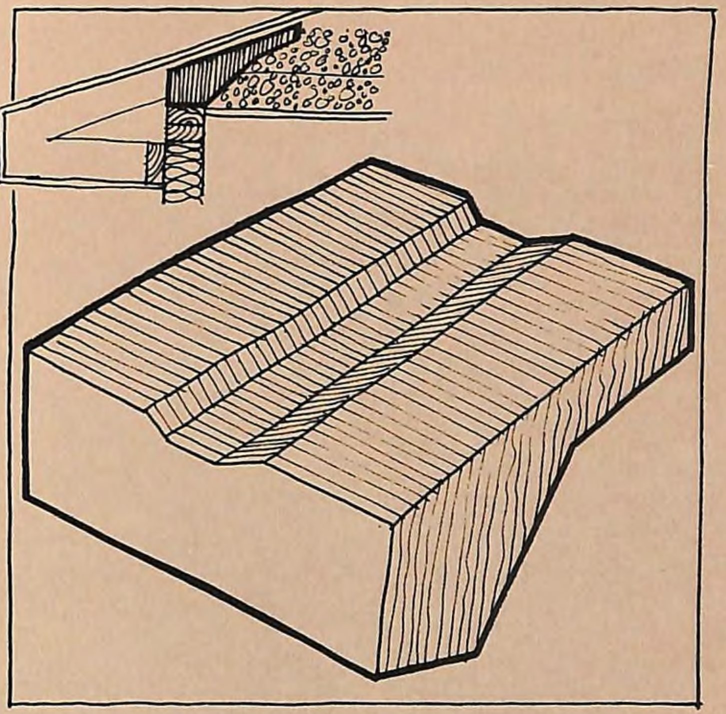
An insulating wind block was placed at the roof edge, and the ceiling insulated. An even insulation value across the ceiling is maintained. The upper side of the roof is kept cold, thus eliminating ice daming problems.



A variety of products have been created to act as insulation stops to block wind washing through a roof eave. A new product, called **PLUSSERS** was featured at this year's CHBA annual convention in Calgary. The Plusser is an expanded polystyrene ('bead-board') block which is a combination insulation stop, insulation and soffit air chute. They are available in two sizes, designed to fit either metric or imperial measure truss spacing. Plussers are normally friction fitted, but can be toe nailed if needed.

The manufacturer claims the insert will provide an equivalent of R34 at the outside wall using standard roof trusses.

The product is accepted by the Alberta Home Mortgage Corp. and the Alberta Building Standards. Its list price is $13.50 per 4 ft. section. Installed cost for a typical house should be $200 - 250.00.



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LETTERS TO THE EDITOR

Sir,

Just a note to compliment you on SOLPLAN REVIEW.

Yesterday I had an enquiry from a father with a small child suffering from allergies. He wants to build a new house that is "cleaner". Was able to send him that excellent piece in the August-September issue. Well done!

R.S. Dumont
National Research Council
Saskatoon, Sask.

Sir,

SOLPLAN REVIEW is used quite frequently here in the Newfoundland Department of Energy library. I personally have always found the magazine very useful and full of up to date information.

In the information section here we deal with one hundred questions per month (in the winter months) and I often find the required information in SOLPLAN REVIEW very quickly. Thanks for a great job.

Jo Heringa
St. John's, Nfld.

Sir,

In SOLPLAN REVIEW No.19 (February-March, 1988), you stated that "ASHRAE (a technical organization with important industry representation) is campaigning against elimination of CFC's". To the best of my knowledge this statement is not correct. I have been associated with ASHRAE for over 25 years and currently serve as Region XI Vice-Chairman for the Education and Chapter Programming Committee of the Society. At no time during any of the Society's meetings have I ever heard anyone state that ASHRAE was against elimination of CFC's.

I would recommend that you review recent issues of the ASHRAE Journal (in particular, the November 1987 issue in which the CFC issue is explored in detail). You will note in most issues for the last year there have been articles on CFC's in which ASHRAE has tried to inform its members as to both the pros and cons of this issue. I think you will find that

ASHRAE's position is quite clear on the fact that certain of the CFC's will probably have to be limited from use within the foreseeable future and replaced with some other refrigerant that does not have the same environmental problems associated with it.

You do your readers a disservice in making statements like you made in the February-March, 1988 issue of SOLPLAN REVIEW. Those of us who are members of ASHRAE and also read Solplan Review will begin to doubt the validity of other statements in it and those who are not members of ASHRAE will, of course, assume that ASHRAE is doing something it shouldn't.

I have subscribed to Solplan Review since, it was first published and enjoy reading it as it provides a "grass roots" look at the building industry. However, no matter the size of the magazine, it is the absolute duty of the Editor to thoroughly check all facts before making public statements or claims.

Donald E. Holte, P.Eng.
Vice Chairman, Education Committee. Reg X1
ASHRAE
Edmonton, Alberta

Perhaps it was intemperate to suggest that ASHRAE was 'campaigning' against elimination of CFC's. Our source for the information was an item in another publication which reported on a resolution passed by the ASHRAE Board of Directors at its meeting in Nashville which stated that "the elimination of fully halogenated CFC's is not justified and may be counterproductive".

The impression left with the observer is that ASHRAE'S leadership is suggesting that action not be taken until an international agreement is in place. In other words, it appears that there is some foot dragging on the issue (just as the USA is doing on acid rain).

There is no doubt that there is much vigorous debate going on about the consequences of CFC use, and ASHRAE has begun exploring the issue.

We can appreciate that the industrial infrastructure and commercial pressures make it difficult to effect quick changes. There is resistance to the quick elimination of the use of such widely used substances - although we note that one major manufacturer has already announced it will stop production within 5 years.

Nevertheless, we feel that the global environmental consequences of CFC's mean that action must be taken sooner, rather than later. If one must err, it should be on the side of safety.

The destruction of the world's environment is something that has unknown consequences. We may not get a second chance (the dinosaurs didn't!). Somebody has to start!

Credits

In SOLPLAN REVIEW No.19 (Feb-Mar 1988) we omitted to give credit where it's due. The study on Wet Basements was undertaken by Unies Ltd. of Winnipeg, Manitoba with funding provided by CMHC. The work is described in a report Titled "Basement Condensation: Field Study of new homes in Winnipeg".

Our apology to those concerned for the omission.

SOLAR WATER HEATER PLANS

In 1979 B.C. Hydro published a step-by-step guide to build your own solar water heater. This is a fully illustrated 80 page book showing how to build and commission a domestic hot water system.

B.C. Hydro has a number of copies of this publication which are available free of charge. If you are interested:

Ask for "Solar Systems in B.C."
B.C. Hydro Energy Management Services
1269 Howe St. Vancouver B.C. V6Z 1R3
604-663-2317

FLUELESS STOVE

A flue-less wood stove? Yes, they do exist!

The "Pellefier" is the name given to a recently developed stove, or more properly, a combustion unit which produces heat efficiently with virtually no smoke or particulate emissions. Heat extraction from the fuel is so efficient that it does not require a conventional chimney or smoke stack. The emissions are vented through the wall by a small pipe.

How is it that almost no smoke or particulate emissions are produced?

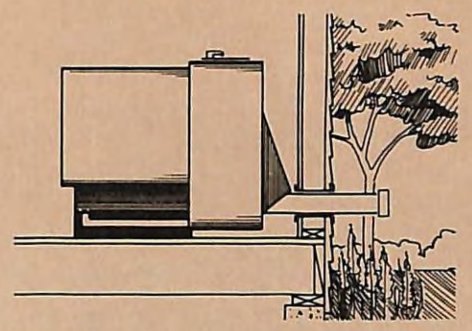
Combustion takes place in two stages. In the first, primary burning takes place in an oxygen deficient environment created by a closely controlled volume of air being introduced along with the fuel into the first burn fireport. This pyrolyses the fuel and results in the production of gaseous emissions rich in burnable components. Combustion of the pyrolysis gases produced in the first stage takes place in the second stage of burning by introducing additional air. The second stage burning produces an aesthetically pleasing visible flame and is the major heat source.

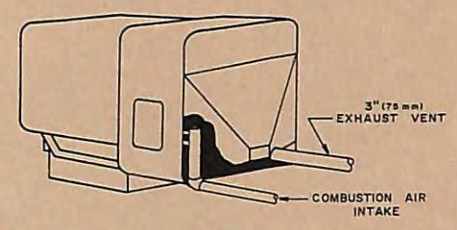
The heat produced is forced by air flowing toward the viewer at the front, so the viewer sees the flame and also feels the heat. The unit has an efficient heat exchange transfer which cools the sides of the unit so no serious burning or scorching will take place if there is accidental contact with the skin. As well, the spent gases emitted from the vent pipe are at a temperature low enough that they will not scorch.

The Pellefier unit is certified by the Oregon Department of Environmental Quality, which has stringent particulate emission standards. Overall efficiency was tested at 87%. Maximum heat output is 41,900 BTU/hr., minimum is 3,000 BTU/hr.

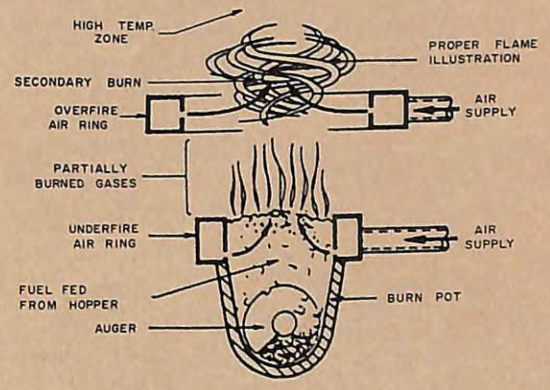
However, to do its job the Pellefier must use wood pellets - not conventional wood logs. It will also operate on other fuels (such as coal and other densified biomass products) which have been crushed or pelletized to maximum sizes of about 3/4".

ZERO CLEARANCE





OUTSIDE AIR INSTALLATION



BURNER

Wood pellets are purchased in bags which are emptied into a hopper at the back of the unit. When filled, the hopper will generally last from one to three days depending on heating requirements. The only contact the user has with the fuel is during loading operations. Fuel is automatically fed from the hopper by auger to the firepot, so it is very clean. The auger and air supply is thermostatically controlled so that heat output can be regulated.

Pellets are made from waste organic material (wood wastes, agricultural waste, peat, etc). There are several pellet plants already in operation in Canada and the United States. The manufacturer estimates the cost of pellets at $100/Ton. At maximum efficiency this would be about $7.00/MBTU (compared to $13.18 for electricity at $.045/kwh).

The unit is manufactured in Delta, B.C. and has ULC, CSA, and UL approvals.

Any drawbacks?

An assured source of fuel is needed. Obviously the stove manufacturer is encouraging the development of new pellet plants. The feed stock is waste organic material, and the manufacturing process is relatively simple, requiring little capital outlay. There is no reason why small local plants will not be set up to produce pellets to serve a regional market.

Unlike the old pot bellied wood stove, this unit is high tech, and uses several internal fans, so it must have power. Continuous operation will use about 100/kwh per month. The unit comes with a 15 year warranty.

As the unit is flueless, there are some restrictions on location of the unit to allow proper combustion and exhaust hook up. Despite its efficiency, there is still some ash generated that will have to be cleaned up about once every 3-4 weeks (depending on use). As well, combustion must be started manually. Although self feeding, it must be refilled every so often (depending on heat demand it could be every one or two days). If the homeowner expects everything to operate automatically, at the flick of a switch, this is not for him.

Information:

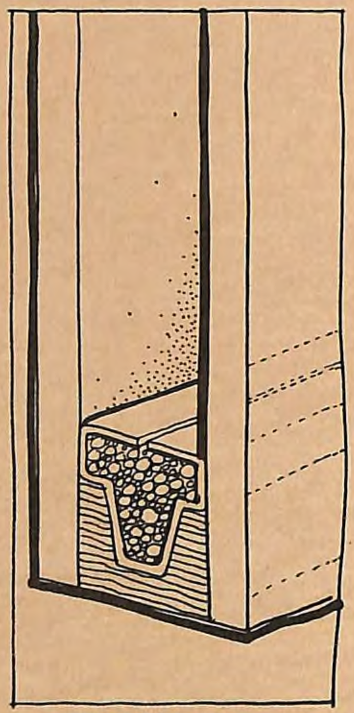
E. H. Hanson Manufacturing Ltd.
#4 - 7550 River Rd.
Delta BC V4G 1C8
Tel. 604-946-5055

WINDOW FRAMING

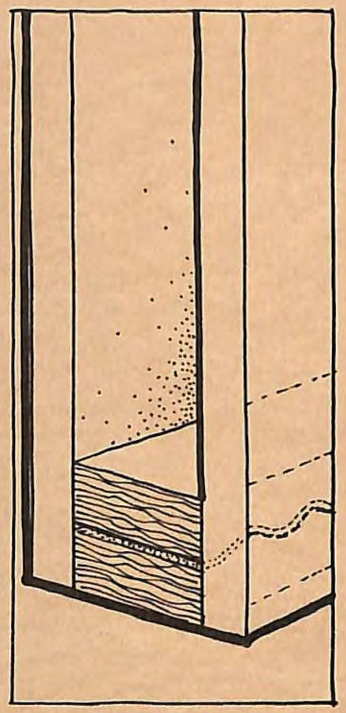
The spacer used in double (or triple) glazing is often an overlooked factor in window design.

Typical double glazing uses aluminum spacer bars between glass panes. The aluminum results in higher heat transfer at the window edge. This will appear as condensation on the inside surface during cold weather.

A study recently performed by Enermodal Engineering of Waterloo, Ontario examined the effect of a variety of spacers in four types of residential window frames, (wood, PVC, fiberglass and thermally-broken aluminum). Butyl ('swiggle strip'), fiberglass and aluminum spacers were compared.



conventional spacer



swiggle strip

The Results?

Replacing aluminum spacers with fiberglass or butyl rubber spacers can **reduce total window heat loss by 3 to 5%** and raise the average inside glass edge temperature by up to 5°C. This means that there would be less condensation on the window.

However, the improvement in window performance due to a better spacer must be kept in mind against the overall window performance - which can vary by up to 22% depending on the framing material and window size. If a builder is to make a choice between 2 manufacturers and it is a choice between like frame types (e.g. aluminum vs aluminum or wood vs wood), then the unit with a butyl or fiberglass spacer will give a better overall performance.

Especially if you are going to pay premium for low-E or triple glazing, you should consider the unit with an improved spacer bar to reduce the thermal bridging at the window edge.

The 'swiggle strip' is a product manufactured by Tremco Ltd. Some window manufacturers are already using it in their products.

COMING EVENTS

OTTAWA, June 23-25, 1988: Energy Solutions For Today. The major Canadian conservation and renewable energy conference of 1988. (14th annual meeting of the Solar Energy Society of Canada). Includes sessions on low energy buildings, and super windows. For information:
Solar Energy Society of Canada
Pent. #3, 15 York St.
Ottawa, Ont. K1N 5S7
Tel: 613-236-4594

TACOMA, WASHINGTON, Nov. 29 - Dec. 3, 1988 Housing for the 90's. The major US Pacific Northwest conference on low energy housing, organized by the Energy Business Assocaition, Seattle, Washington.
Info: Tel. 206-622-7171

THERMOGRAPHY

What does air tightness in a building envelope mean to heat loss?

Thermograph scans to measure heat loss done on Winnipeg area houses by Ike Warkentin give us an idea.

Fig. 1 show the heat loss across a wall with plastic air barrier boxes. The temperature drop at the electric box was 2°C. (At the time of the test there was a 51°C temperature difference between inside and outside).

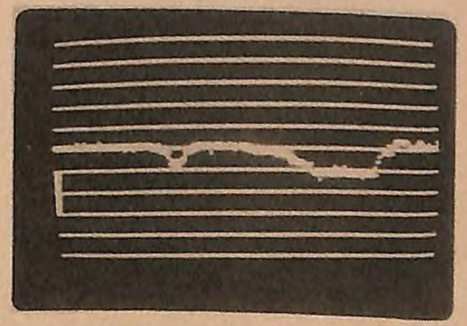


Fig. 1 Each line represents 2°C

Fig. 2 shows the heat loss across a similar wall that had no boxes on the outlets. The temperature drop was 6°C (with a 34°C temperature difference between inside and outside).

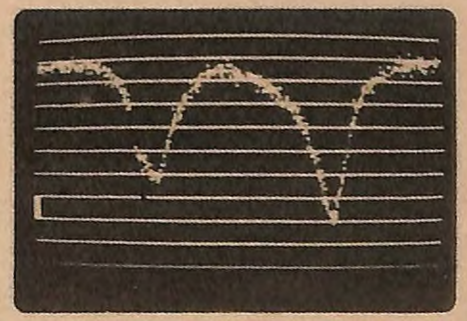


Fig. 2 Each line represents 1°C

ISBN: 0-920768-07-5